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The Patent Office

Cardiff Road
Newport
Gwent NP9 1RH**1. Your reference**

SMR/TLB/P73221

2. Patent application number*(The Patent Office will fill in this part)*

28 JAN 1999

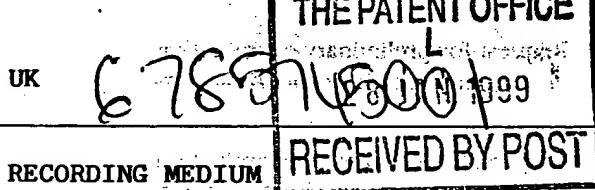
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3. Full name, address and postcode of the or of each applicant (underline all surnames)

Rexam Coated Products Limited
 9th Floor West
 114 Knightsbridge
 London SW1X 7NN

Patents ADP number *(if you know it)*

If the applicant is a corporate body, give the country/state of its incorporation

**4. Title of the invention**

RECORDING MEDIUM

5. Name of your agent *(if you have one)*

URQUHART-DYKES & LORD

*"Address for service" in the United Kingdom to which all correspondence should be sent
(including the postcode)*

Midsummer House
 411c Midsummer Boulevard
 Central Milton Keynes
 MK9 3BN

Patents ADP number *(if you know it)*

1644008

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number

Country	Priority application number <i>(if you know it)</i>	Date of filing (day / month / year)
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7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application

Date of filing
(day / month / year)**8. Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if:***

- a) any applicant named in part 3 is not an inventor, or
- b) there is an inventor who is not named as an applicant, or
- c) any named applicant is a corporate body.

See note (d))

Yes



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Continuation sheets of this form

Description

3

3



Claim(s)

3

Abstract

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Drawing(s)

—

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Priority documents

Translations of priority documents

Statement of inventorship and right to grant of a patent (Patents Form 7/77)

Request for preliminary examination and search (Patents Form 9/77)

Request for substantive examination (Patents Form 10/77)

Any other documents
(please specify)

11.

I/We request the grant of a patent on the basis of this application.

Signature

Urquhart-Dykes

Date 27.01.99

URQUHART-DYKES & LORD

12. Name and daytime telephone number of person to contact in the United Kingdom

Mr Simon Raynor
01908 666645

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RECORDING MEDIUM

The present invention relates to a recording medium and in particular, but not exclusively, to a plain paper recording medium for use with the Indigo™ digital printing press.

- 5 The Indigo digital press made by Indigo NV requires special paper surfaces to enable complete toner/ink transfer from printing blanket to paper. Such complete transfer is essential to allow variable information to be printed on successive sheets.

It is known that commercially available pigment coated printing papers satisfy the requirement of 100% toner transfer, however for aesthetic and cost reasons printers
10 wish to use papers of uncoated appearance. For instance: a translucent or semi-translucent paper would have its translucency diminished by pigment coating; coated papers are often glossy; the surface texture of an uncoated paper feels more natural.

One non-pigmented surface treatment which leaves paper with an uncoated appearance yet renders it suitable for the Indigo press has been developed by Arjo Wiggins PLC.

- 15 This is known commercially as the Sapphire treatment. It involves application to the surface of the paper of a polyethylene imine such as Polymim P made and sold by BASF. This can be applied to the paper surface either as part of the paper-making process or as a separate operation. In the latter case it can be used as a post-treatment on a commercially available ordinary litho printing grade.
20 A problem exists with Sapphire treatment in that the treatment renders the substrate unsuitable for standard lithographic printing. This limits the usability of the process: such a sheet of paper cannot carry both lithographic non-variable plus Indigo variable information. Separate stocks of paper therefore need to be manufactured and warehoused for litho and Indigo; whereas post-treatment of a plain litho paper incurs
25 extra production costs.

According to a first aspect of the present invention there is provided a recording medium for use on a digital printing press (for example the Indigo press), the recording medium including a paper substrate having a surface treatment of a water-soluble cationic substance and a water-soluble binder. For example, the recording
30 medium may comprise a translucent paper with a surface treatment of polyvinyl

pyrrolidone (PVP) and magnesium sulphate ($MgSO_4$) with a synthetic sizing agent, for example Baysynthol KSN B.

According to a second aspect of the invention there is provided a recording medium for use on a digital press, the recording sheet including a paper substrate having a

- 5 mineral filler including a Lewis acid, for example aluminium trihydrate ($Al(OH)_3$). The recording medium may be an opaque paper including a surface treatment, for example polyvinyl pyrrolidone and magnesium sulphate or starch plus polyvinyl alcohol (PVOH).

Embodiments of the invention will now be described by way of example.

- 10 We have found that three things work particularly effectively:

1. Translucent paper with a surface treatment of polyvinyl pyrrolidone + magnesium sulphate + Baysynthol KSN synthetic sizing agent.
2. Opaque paper with a mineral filler of aluminium trihydrate (Martifill) and a surface treatment of polyvinyl pyrrolidone + $MgSO_4$.
- 15 3. Opaque paper with a mineral filler of aluminium trihydrate and a surface treatment of starch plus polyvinyl alcohol.

The results of using the above formulae are summarised in the following table:

	Printability	Indigo	Litho	Inkjet (including pigment inks)	Hotmelt Inkjet
20	Formula 1	yes	?	yes	?
	Formula 2	yes	yes	yes	yes
	Formula 3	yes	?	yes	yes

- 25 The surface treatment in formulae 1 and 2 is the same as the one we claimed for pigment based ink-jet on translucent paper, described in patent GB 2 301 845B the contents of which are incorporated by reference herein.

It would seem that the Baysynthol is not essential for the indigo process. The suitability of the paper for use in the indigo process appears to depend on either the

presence of a soluble metal cation (Mg^{2+}) or Lewis acid filler ($Al(OH)_3$) or on a slightly "tacky" polymer such as polyvinyl pyrrolidone or polyvinyl alcohol. We suspect the group II or III metals are the key. Further investigation of this aspect of the invention is required.

5 The preferred surface formulation for 1 and 2 is:

	parts by dry weight	e.g.
magnesium sulphate	75	
polyvinyl pyrrolidone	25	Luviskol K90
Styrene copolymer size	0 to 2.5	Baysynthol KSN B
10 Typical application weight: 0.5 to 5 g/m ²		

Variants of the formulae, for example as described in GB 2 301 845B are possible. For example:

cation:	polyvalent metals ions of groups II and III and transition metals of the periodic table
15 cation:	poly quaternary amine or other Lewis acids
Binder:	starch, cationic starch, carboxymethyl cellulose, gelatine, polyvinyl alcohol, polyvinyl pyrrolidone, singly or in admixture of 2 or more
Base:	opacity 20 to 98+, grammage 40 to 300
20 Size:	styrene maleic anhydride, polyacrylate, styrene acrylate or other sizes known in the art

Formulation for Base for 2 and 3:

Aluminium hydroxide a.k.a. trihydrate (e.g. Martifill P2) 18% on dry fibre.

Possible variants include the internal sizes and different particle size of filler.

25	Surface formulation for 3	
Starch	200 dry parts	e.g. oxidised potato - Amyloxx P45 from Avebe
Polyvinyl alcohol	25 dry parts	e.g. gohsenol GL05 from Nippon Gohsei
Possible variants include cationic starch, other starches, different PVOHs.		

CLAIMS

1. A recording sheet for use on a digital press, the recording sheet including a paper substrate having a surface treatment including a water soluble cationic substance and a water soluble binder substance.
- 5 2. A recording sheet according to claim 1, wherein the cationic substance is a soluble polyvalent metal salt.
3. A recording sheet according to claim 2, wherein the cationic substance is a salt of a metal from Groups II and III or the Transition Metals of the Periodic Table.
4. A recording sheet according to claim 3, wherein the cationic substance is a salt 10 of a cation selected from the group consisting of Mg^{2+} , Ca^{2+} , Al^{3+} , Zr^{4+} and Zn^{2+} .
5. A recording sheet according to claim 4, wherein the cationic substance is magnesium sulphate.
6. A recording sheet according to claim 5, wherein the amount of magnesium sulphate applied to the surface of the recording sheet is in the range 0.5-3.0g/m², and 15 preferably 1.0-2.0g/m², and advantageously approximately 1.25-1.75g/m².
7. A recording sheet according to claim 1, wherein the cationic substance is a cationic polymer.
8. A recording sheet according to claim 7, wherein the cationic substance is a poly-quaternary amine.
- 20 9. A recording sheet according to any one of the preceding claims, wherein the binder substance is selected from a group consisting of polyvinylpyrrolidone, polyvinyl alcohol, carboxylated cellulosic polymers, polyacrylic acids, hydroxylated polyacrylates, polyacrylamides, starches and gelatine.
10. A recording sheet according to claim 9, wherein the binder substance is selected 25 from a group consisting of carboxyalkyl polymers and hydroxyalkyl polymers, and preferably hydroxymethyl cellulose and hydroxypropyl cellulose, and is more preferably carboxymethyl cellulose.

11. A recording sheet according to claim 9 or claim 10, wherein the binder substance has a molecular weight in the range 790,000 to 1,350,000.
12. A recording sheet according to claim 9, wherein the binder substance is polyvinylpyrrolidone having a viscosity defined by a K-value of at least 30, and
5 preferably at least 60 and advantageously approximately 90.
13. A recording sheet according to claim 12, wherein the amount of PVP applied to the surface of the recording sheet is in the range 0.15-0.75g/m², and preferably 0.4-0.7g/m², and is advantageously approximately 0.5g/m².
14. A recording sheet according to any one of the preceding claims, in which the
10 substances are applied to the surface of the recording sheet as an aqueous solution.
15. A recording sheet according to any one of the preceding claims, in which the recording sheet has a substantially uncoated appearance.
16. A recording sheet according to any one of the preceding claims, the recording sheet being suitable for use both on a digital press and in a litho graphic printing
15 process.
17. A recording sheet according to claim 16, the recording sheet being suitable for laser printing, inkjet printing with dye and pigment based inks and hot melt imaging.
18. A method of manufacturing a recording sheet for use on a digital press, the method including treating the surface of a paper substrate with a surface treatment
20 including a water soluble cationic substance and a water soluble binder substance.
19. A method according to claim 18, wherein the recording sheet is treated by applying an aqueous solution of the cationic and binder substances to the surface of the sheet.
20. A method according to claim 19, wherein the solution is applied by drawing the
25 semi-manufactured recording sheet through a bath of the solution.

21. A sheet of paper with a substantially uncoated appearance for use on a digital press, the paper having a surface treatment including a water soluble cationic substance and a water soluble binder substance.
22. A recording sheet for use on a digital press, the recording sheet including a paper substrate having a mineral filler including a lewis acid.
5
23. A recording sheet according to claim 22, wherein the lewis acid includes $\text{Al}(\text{OH})_3$.
24. A recording sheet according to claim 22 or claim 23, wherein the recording sheet has a surface treatment including Mg^{2+} and polyvinyl pyrrolidone.
- 10 25. A recording sheet according to claim 22 or claim 23, wherein the recording sheet has a surface treatment including starch and polyvinyl alcohol.
26. A recording sheet according to claim 22 or claim 23, wherein the recording sheet has a surface treatment including a soluble or insoluble metal from Groups II and III or the Transition Metals of the Periodic Table.